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U. S. Department
of Agriculture

APHIS-PPQ

APHIS 81-46
September 1985

Pest

PESTS NOT KNOWN TO OCCUR IN THE UNITED STATES OR OF LIMITED
DISTRIBUTION, NO. 66: SPRUCE BARK BEETLE

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Order: Family

SPRUCE BARK BEETLE
Ips typographus (L.)

Economic
Importance

Ips typographus is one of the most destructive pests of spruce in Europe. This pest usually infests weakened or recently downed trees or logs, feeding on the phloem of the bark. Healthy trees are invaded during outbreaks. Extensive injury to forests from fires and storms, supports the buildup of high populations of this species resulting in excessive damage. Following storms in Sweden in 1932, populations peaked over 1 million per hectare in spruce forests (U.S. Department of Agriculture 1959). During 1936 through 1937, this species killed about 120,000 spruce trees in that country. Following injury from World War II, weakened forests in central Europe supported an outbreak that destroyed 30 million cu m of wood. This species destroyed about 3 million trees during 1956 through 1960 in Japan (Annala 1969).

Hosts

I. typographus is principally associated with Picea abies (Norway spruce). It sometimes infests other species of Picea, Abies spp. (firs), and Pinus spp. (pines), and more rarely Larix spp. (larch) (Browne and Laurie 1968).

General
Distribution

Unless cited otherwise, the Commonwealth Institute of Entomology (1976) listed the following countries for this pest: Europe - Austria, Belgium, Bulgaria, Czechoslovakia, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway (Botterweg 1982), Poland, Romania, Sweden, Switzerland, and Yugoslavia; Asia - China (northern) (Novák et al. 1976), Japan, and Korea; and from the Soviet Union (European part, Georgian SSR, Siberia (Northern Sayansk Mountains), and Sakhalin Island).

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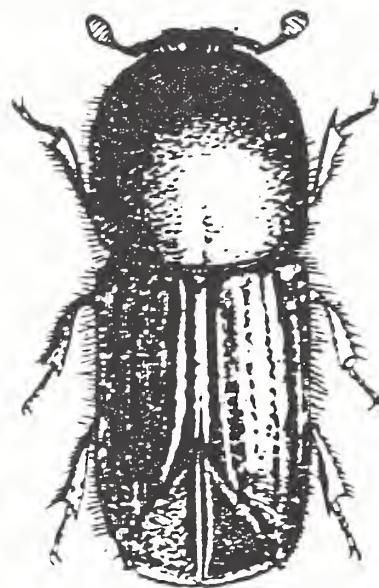
Ips typographus distribution map prepared by Non-Regional
Administrative Operations Office and Biological Assessment
Support Staff, PPQ, APHIS, USDA

Characters

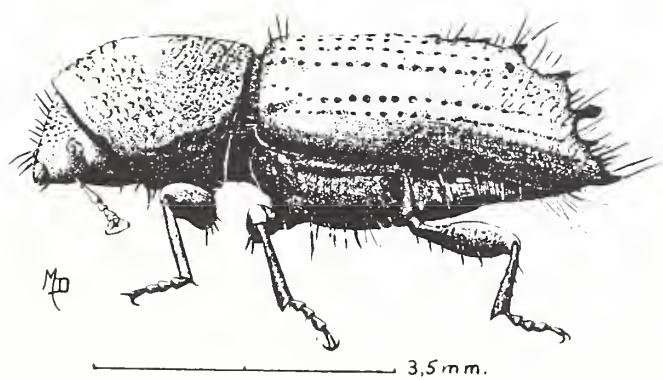
ADULTS (Fig. 1) - Length about 4.2-5.5 mm from apex of pronotum to apex of elytra. Entire body dark brown to almost black, sub-cylindrical with hairlike vestiture. Front of head covered with long yellowish setae and small granular tubercles, and bearing a conspicuous median tubercle above epistomal margin. Antennal funicle 5-segmented, club flattened, broadly oval, divided on outer face by 3 procurved sutures, 2d suture strongly angulate in middle (Fig. 2A). Prothorax slightly longer than wide, declivitous above anterior margin, coarsely asperate with long yellowish setae anteriorly and laterally; central posterior area glabrous and finely punctate, with impunctate median line in most specimens. Elytra about 1.5 times as long as their combined width, with striae distinctly impressed dorsally, and with long, yellowish setae most abundant laterally. Elytral declivity (Fig. 2C) steep, strongly excavated, with raised sutural line, and bounded on each side by 4 marginal teeth,

third from top largest and capitate in both sexes; apical margin smooth and shelflike. Declivity surface dull, finely punctate, devoid of setae except on margins and in narrow upper part. Tibiae flattened, outer margins with coarse teeth.

(Fig. 1)



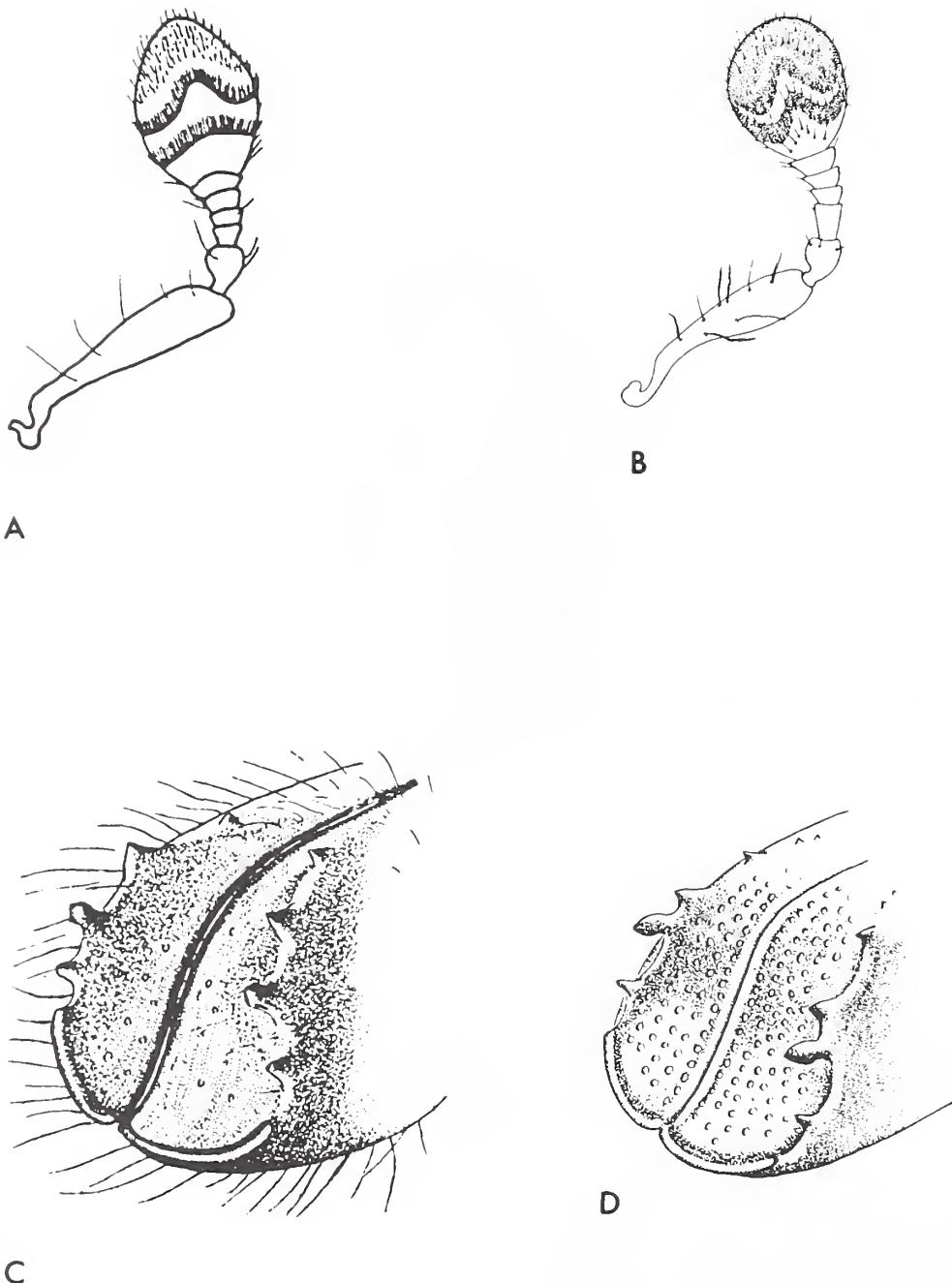
A



B

Ips typographus adults. A. Dorsal view. B. Lateral view (A from Taschenberg 1884; B from Chararas 1962).

(Fig. 2)



Adult structures of *Ips* species. Antenna (outer face):
A. *I. typographus*; B. *I. plastographus*. Elytral declivity:
C. *I. typographus*; D. *I. plastographus* (drawn without setae)
(A from Grüne 1979; B from Hopping 1963b; C from Balachowsky
1949; D from Hopping 1963a).

ADULT COMPARISONS - Ips typographus is separated from other European Ips species in keys by Balachowsky (1949), Pfeffer (1955), and Grüne (1979). As indicated by Wood (1982), the North American Ips species most closely resembling typographus are those in his plastographus group (Group III of Hopping 1963c). These species, Ips plastographus (LeConte) and I. integer (Eichhoff), resemble I. typographus in having 4 pairs of marginal teeth on the elytral declivity (Fig. 2D), acutely angled sutures on the antennal club (Fig. 2B), and a median tubercle above the epistomal margin. However, the plastographus group species differ from I. typographus in having the 2d and 3d marginal teeth of the declivity (Figs. 2D versus 2C) spaced more closely, with the 3d tooth more acutely pointed in males and not capitate in females, and the first 2 sutures of the antennal club (Figs. 2B versus 2A), rather than only the 2d suture, acutely angled in the middle. All other North American Ips species having 4 pairs of declivital teeth differ from I. typographus in the shape and arrangement of those teeth, do not have any acutely angled sutures on their antennal clubs, and may not have any sort of median tubercle on the front of the head. Finally, all of the North American Ips species with 4 pairs of declivital teeth are normally associated with species of pine, whereas I. typographus usually attacks spruce trees. Because of its unique combination of taxonomic characters and host preferences, I. typographus will not key past couplet 7 in the key to North and Central American Ips species by Wood (1982).

EGGS - No published description of the eggs of this species is available, but they may be presumed to agree with the general description of scolytid eggs by Wood (1982) as being "smooth, oval, white, translucent, delicate objects varying in size from one group to another". Trimble (1924) described the eggs of Ips plastographus as "slightly oblong, rounded at the ends, pearly white, shiny, three-quarters of a millimeter long, and three-fifths of a millimeter wide at the broadest part."

LARVAE - Maximum length about 5.0 mm. Body (Fig. 3A) white, C-shaped, legless, thickest through thorax, sparsely covered with inconspicuous setae. Head (Fig. 3B) unretracted, nearly circular in outline, convex above, light brown, except for dark brown mandibles, with several pairs of setae. Frons (Fig. 4A) subcordate, bearing 5 pairs of setae, most of surface sculptured (Fig. 4B), faintly visible endocarinal line at apex. Antenna (Fig. 4C) reduced to membranous field bearing subconical accessory appendage and 6 tiny sensory processes. Mandible (Fig. 4D) with 3 teeth and pair of subequal setae. Maxillary palpi 2-segmented. Epipharynx (Fig. 4E) and premental

area of labium (Fig. 4F) as figured. Pronotum without pigmented plates. First 7 abdominal segments with 3 dorsal folds. Anal opening subrectangular, surrounded by 6 small lobes.

(Fig. 3)

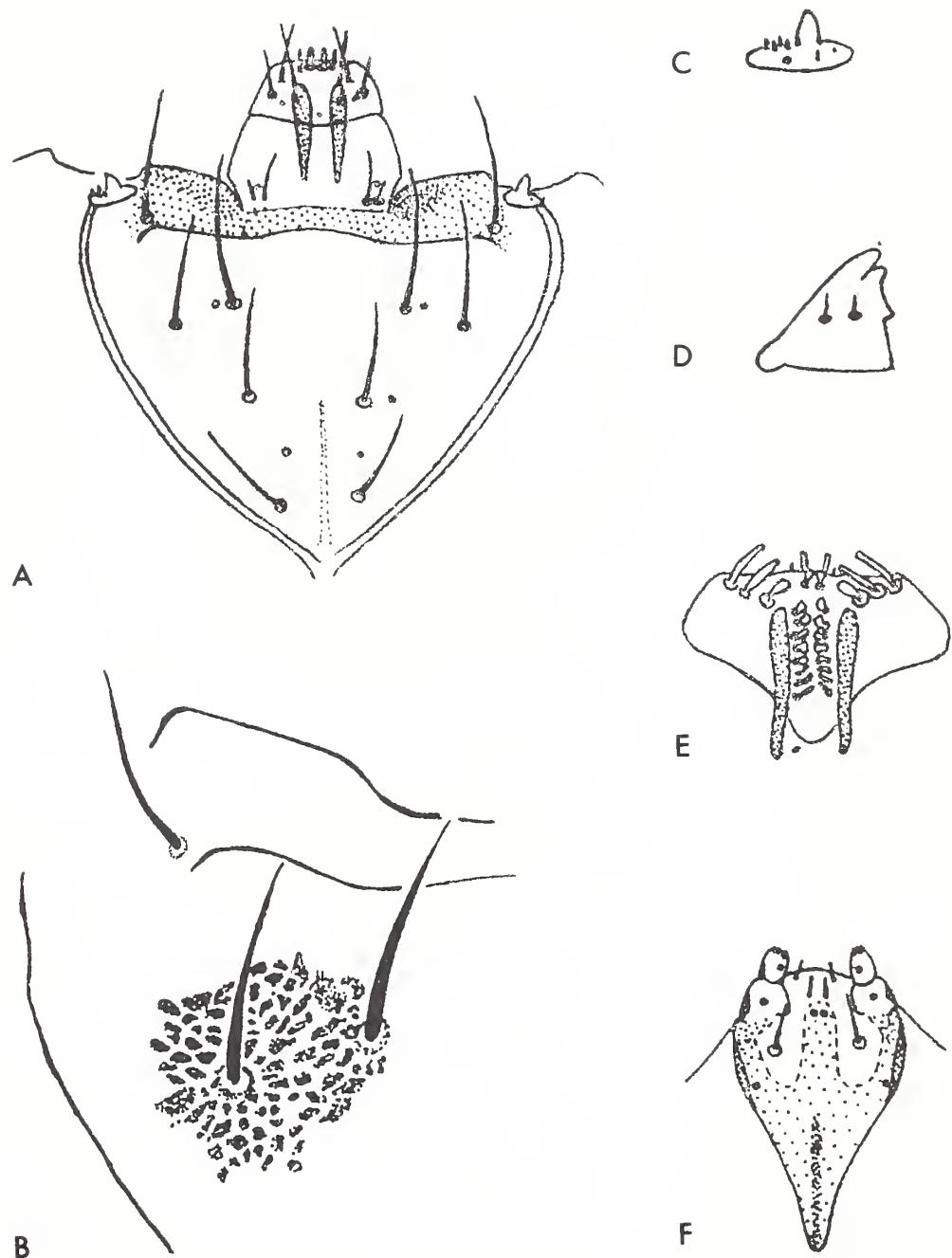


Ips typographus larva. A. Lateral view. B. Head capsule, dorsal view (A from Pfeffer 1955; B from Lekander 1968).

LARVAL COMPARISONS - The larva of this species cannot be compared with those of North American *Ips* species because very few of the latter have been described. It will key to *Ips* in the key to larvae of selected North American genera and species of Scolytidae by Thomas (1957). Larvae of *I. typographus* are separated from those of other *Ips* species in northern Europe in the key to Scandinavian *Ips* larvae by Lekander (1968). The figures of *I. typographus* larvae in the latter work are reproduced here for comparison with larvae suspected to be that species. Slide mounts of dissected larvae will be necessary to examine the smaller structures figured.

PUPAE (Fig. 5) - Length about 5.5 mm. White when newly formed, body form and appendages as figured. Head bearing 3 pairs of setae on lower frontal area. Prothorax with 8 pairs of prominent setae on short tubercles anteriorly, posteriorly, and laterally. Scutellum flat, without setae. Meso- and metathoracic terga each with 2 pairs of short setae. First 6 abdominal terga with 4 pairs of short setae. Abdominal pleural folds prominent, subangular. Terminal abdominal segment with pair of large, posteriorly projecting tubercles with sharply pointed, pigmented tips.

(Fig. 4)



Larval structures of *Ips typographus*. A. Frons (or frontal shield), clypeus, and labrum, dorsal view. B. Frons, lower left area, enlarged, showing surface sculpture. C. Antenna. D. Mandible, dorsal view. E. Epipharynx. F. Premental area of labium, ventral view (From Lekander 1968).

(Fig. 5)



Ips typographus pupa, ventral view (From Taschenberg 1884).

PUPAL COMPARISON - The characters that would be useful in distinguishing pupae of this species from those of other Ips species are unknown because the pupae of so few species of Ips have been adequately described. A careful comparison of unknown bark beetle pupae with the foregoing description may be helpful in making preliminary identifications.

Characteristic
Damage

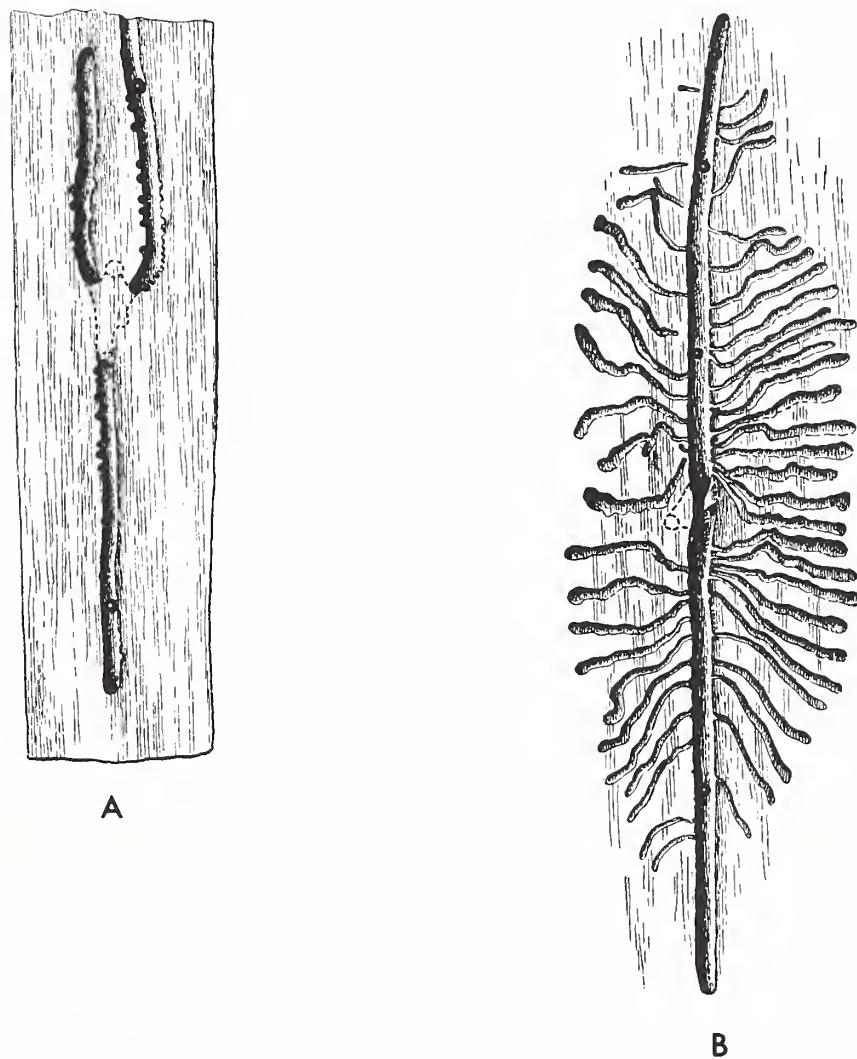
This engraver beetle scores a large gallery system (about 0.33 m long) into the wood (Walker and King 1974). The egg galleries of Ips typographus are fairly constant in pattern and to some degree may indicate the species present. Egg galleries may vary from the general pattern, however, depending on population and whether attack is on felled or standing trees. This species normally constructs a 3-armed gallery system (Fig. 6A) with egg galleries starting from a central nuptial chamber (U.S. Department of Agriculture 1959). Each gallery extends about 15 cm (Browne and Laurie 1968), invariably along the long axis of the trunk. Larval tunnels (Fig. 6B) seldom exceed 3.2 cm in length (U.S. Department of Agriculture 1959).

Detection
Notes

This pest may move from country to country in several ways. Possible pathways are through the international movement of dunnage with cargo, wood bracings in cargo, sea containers, wooden crating with cargo, or as cargo itself, such as lumber and logs. Wood products entering the United States are subject to inspection under various regulations, mainly Title 7, Part 330.105 of the Code of Federal Regulations.

I. typographus has been intercepted at U.S. ports of entry in cargo from Austria, Belgium, Denmark, Finland, France, Italy, Japan, Netherlands, Norway, Poland, Portugal, Romania, Soviet Union, Spain, Sweden, Switzerland, United Kingdom, and West Germany 168 times from 1971 to 1983. Interceptions were made often from Italy and West Germany. Most were taken from cratings and dunnages. Interceptions from Portugal, Spain, and the United Kingdom, countries not cited in the literature as infested, may represent transshipments from other areas.

(Fig. 6)



Galleries of Ips typographus. A. Three-armed gallery showing egg pockets, nuptial chamber outlined. B. Larval tunnels (From Boas 1923).

This species can be detected in the following ways.

1. Look for adults on the ground, in fallen trees, or in the butt of trunks while they hibernate.
2. Note adults swarming during warm weather.
3. Look under the bark of spruce, fir, or pine logs or weakened trees for three-armed galleries.

Submit in alcohol for identification any suspect larvae, pupae, or adults. Submit adults if possible, but send all stages found. For identification by the U.S. Department of Agriculture, send the specimens to: Insect Identification and Beneficial Insect Introduction Institute, Room 1, Bldg. 003, Beltsville Agricultural Research Center - West, USDA, Beltsville, MD 20705.

Biology

In central and northern Europe, adults overwinter mainly on the ground, in moss, or in fallen trees under the snow, occasionally in standing trees (Annila 1969), and some in the butt of trunks (Rozhkov 1970). When the temperature rises above 7° C in the spring, adults leave hibernation (Annila 1969). Adults do not fly immediately to breeding material from hibernation (Zumr 1982); they seek nearby food, such as fresh pieces of bark, branches, or cones, before becoming sexually mature (Annila 1969). They leave these and start to swarm between 17.5 and 23° C following exposure to direct sunlight (Zumr 1982). During the first days of swarming, adults fly during afternoon hours; later, swarms begin before noon and continue almost until sunset. Chilly weather interrupts swarming (Annila 1969). The adults fly mostly with the wind. Distances covered may exceed 8 km (Botterweg 1982). They look for fresh breeding material, such as windfalls, parts of freshly broken trees lying on the ground, or physiologically weakened trees, occasionally even healthy trees.

At first, a majority of males arrive at a tree, but at the end of the attack, females predominate. The normal sex ratio is 2 or 3 females per male. The adults construct their breeding galleries in thick, succulent bark, but will adapt readily to bark of different thicknesses. They generally prefer parts of the tree more than 0.9 m from the ground (U.S. Department of Agriculture 1959).

The gallery system comprises a central nuptial chamber and usually 2 or 3 egg galleries which tend to be longitudinal and 15 or more cm long (Browne and Laurie 1968). Females lay eggs at regular intervals in pockets along the sides of the galleries. Egg laying often occurs over 3 weeks or more. Before the last eggs are laid, larvae from the first-laid eggs are half grown (U.S. Department of Agriculture 1959). Larvae construct relatively short and markedly transverse galleries, ending with a pupal cell in thick bark (Zhuravlev and Osmolovskii 1964).

In the laboratory at 14 and 24° C, the egg stage lasts 5-9 days, larval stage 11-22 days, and pupal stage 7-13 days. There are three larval instars (Annila 1969). Under normal conditions in central and southern Europe, complete development takes 8-10 weeks with two generations a year appearing in spring and summer. In northern Europe, only one generation occurs per year (Novák et al. 1976).

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